### Accelerator Systems Division Highlights for the Week Ending April 18, 2003

#### **ASD/LANL: Warm Linac**

#### HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) SC linac transmitter S/N 002 was shipped to ORNL. We also completed factory acceptance tests for S/N 003. (2) High peak power tests on the DTL windows are in progress. (3) We approved the low power data from CPI for SC linac klystrons S/N 16 and 17 and authorized shipment.

Concerns & Actions: (1) The 5 MW CCL RF system continues to be our biggest concern. We made progress on the delays from Thales reported last week. Instead of 12 weeks for a klystron correction plan, they committed to getting us a fixed tube in June. We are continuing to watch this very closely. (2) The AFT representative was at LANL and we high power tested the 5 MW circulators. The new Kapton window design was proved out, but the circulator did not pass the high-power acceptance tests. We believe this due was due to broken down SF<sub>6</sub> from the klystron window arcs. The circulator will be high power tested with an isolated SF<sub>6</sub> system. (3) On 4/17, we lost vacuum on the 5 MW Thales tube at LANL. The cause is under investigation. A formal critique of operation parameters, procedures, and warranties is being scheduled for 4/21.

# HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) Prototype HV converter-modulator (HVCM) operation supported the 2.5 and 5 MW RF testing at Los Alamos. Unit ran without failure. (2) The forth production HVCM unit rebuild at LANL is complete and unit is ready for final installation. (3) Modeling continues on IGBT switching and DSP control related considerations.

<u>Concerns & Actions</u>: Rej and Bretzke held a follow-up teleconference with the Dynapower Company President regarding QA. D. Anderson was at Dynapower to witness 5th production HVCM unit testing. Several QA problems were found and are being corrected. Reass and Bretzke plan to travel to Dynapower next week for testing of the 5<sup>th</sup> and 6<sup>th</sup> units.

#### DRIFT-TUBE LINAC (WBS 1.4.2)

# Accomplishments:

<u>Tank-1</u>: (1) Rebuilt drift tubes are arriving at LANL at the rate of 6-8 per day for final processing. We are projecting we will ship the first batch of to ORNL on Saturday 4/19. (2) 46 top hats are nearing completion; balance is being plated. (3) Water manifold parts are being gathered for shipping to ORNL.

Tank-4: (1) Interior cavity machining of drive iris halves continues. (2) Plating for equatorial braze is projected to begin the end of next week. (3) 28 additional diverters had sleeve braze completed. (4) Water channel welding of batch A drift tubes were completed at Hanford. Batch A will be shipped to CMI Saturday. Batches B, C & D and B are at Hanford undergoing or awaiting water channel welding. (5) Tank stand is at powder coater.

<u>Tanks –5 & 6</u>: (1) Interior cavity machining of T-5 drive iris halves continues; (2) Ten of the 19 T-5 drift tube bodies have water channels machined. (3) All remaining bodies are ready for cooling channel machining. (4) Eleven sleeves still require final OD machining. (5) All sleeves require diverter hole machining.

<u>Tank -2</u>: (1) Work to machine bodies and sleeves through thermal shrink step has been "broken out" of main contract SOW. It is being procured separately so this work may be started with the next week or two to gain schedule time. (2) Award for the fabrication of a drift tube prototype for qualification of a second machining vendor has been made.

EMD Drift Tubes: All drawings of revised design (incorporating qualified e-beam welds) are complete. Concerns & Actions: Three of the non-repaired original EMD Tank-3 drift tubes (3-23, 3-26 & 3-29) are leaking from the magnet cavity; differential pumping through the magnet lead tubes is keeping ahead of the leaks. Tank pressure is down to 1E-6 Torr. No repairs were done on these EMD units.

### COUPLED-CAVITY LINAC (WBS 1.4.4)

<u>Concerns & Actions</u>: A design was completed and implemented to correct the tuning whole problem reported last week. The design utilizes a repair "dimpling plug" somewhat similar to that used on LIBO at CERN. A prototype plug was built and brazed into a test cell at ACCEL.

#### PROJECT MANAGEMENT (WBS 1.4.6)

Scotty Jones has accepted the position of Operations Specialist 3 for the LANL SNS Division, effective 4/21/03. Scotty is currently our Operations Specialist focusing on Safety and Security. In an attempt to bring added resources to QA and Records Management, Scotty will now be responsible for these functions as well. Scotty is a well-

respected safety specialist at the LANL, with a breadth of experience in ES&H and Quality Assurance. He is a certified safety professional, Hazardous Materials Shipper Instructor, and has experience in both the private and public sector.

#### ASD/JLAB: Cold Linac

### ASD/BNL: Ring

Tests of the 36CDM30 corrector magnet were completed with good results. The vendor (NETC) has been authorized to proceed with the production fabrication.

Ring half-cells: #6 was shipped this week. Work is underway on half-cells #7, 8 and 9.

A contract was awarded to Alpha Magnetics to build the injection chicane #1 bending magnet.

Ranor, Inc. was awarded a contract to build the outer shielding for the two HEBT collimators. BNL reps were at Ranor this week to review the overall design package.

The 1<sup>st</sup> article 27CD30 magnet has been received from NETC. The magnet will be uncrated and inspected next week. After acceptance testing at BNL, the remaining production units (19) will be shipped directly to SNS/OR.

Stangenes reported the shipment of the 1<sup>st</sup> article production 26Q40 this week. They planned delivery rate is one every three weeks.

At the request of ASD, a contract change order is being prepared to have NETC add cable lug plates to the dipole magnets that they are building for us. NETC will hold chicane #2, which is ready for shipment to BNL, to accommodate the requested change.

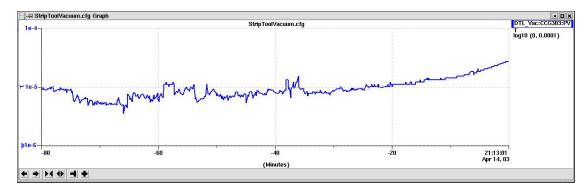
BINP: Budker reported a partial shipment of five production quads 30Q44/58 to BNL this week. ETA is ~4 weeks.

Magnetic measurements continue on the 27CDM30, the 26Q40 (baseline), the 41CDM30 and the Ring injection septum. Measurements of the 21CO26 are complete (9/9). The 27CD30 magnet is next in line.

# Controls

Sadly, this was our first week without BJ. We survived.

At BNL, the electronics to trip the Machine Protection System (MPS) on high beam loss detected by a Beam Loss Monitor (BLM) has been successfully bench tested. The bias voltage on an SNS BLM ion chamber was pulsed to simulate a high loss condition, and the resultant MPS trip was observed. An MPS "latched input was used. (Not the usual input for the BLM system, but useful for debugging.) The test setup is illustrated in the pictures below. The first is the BLM test, and the second is a test with the beam dump ControlLogix PLC, which uses the same MPS interface components as the vacuum PLC.







Cryogenic controls information can now be read from the CHL control room, and remotely from 701SCA.

The control system archiver and stripchart tool continued to be used to help with diagnostics of the vacuum leak(s) in DTL3. An example chart is shown.

At LANL, power supply screens were completed for the D-Plate; the steering rack was tested and power supply I/O was calibrated. D-Plate video hardware was readied for shipment to ORNL. D-Plate vacuum and cooling system PLC and IOC software was also completed. Work continued on supporting DTL1 and 3 vacuum and RCCS software checkout and testing, both locally and at ORNL. The DTL3 thermocouple database, screens and code are nearly complete. They will accompany the engineers visiting ORNL next week. Work continued on the High-Power RF system – inter IOC communication was tested and the High-power Protect Module screens were updated. LANL continued to build fiber to copper transition modules for the SNS network. Finally, the archiver is being ported to the most recent version of EPICS. This is required at the SNS site before the operational system can be fully converted to the most recent EPICS release.

High-level screens for DTL1, DTL1-DPlate, and DTL3 are in place at the site and linked to the linac-map screen. Information has been requested from subsystem designers to complete the links to high-level summary data.

An update to the "Magnet Power Supply Controls DTL1, D-Plate System, and Magnet Test Stand Operation FSD" reflecting the latest arrangements for power supply location, etc. was released this week. When the fiber connections between the power supply controller and the power supply interfaces are completed, the system will be ready to download and test power supply control software from LANL.

The "Phase 0.3" Personal Protection System (PPS) to operate DTL3 as is 99% complete. A Certification dry run of the system was completed in preparation of an official certification planned for Monday, April 21. The only remaining tasks are to install entry requirements signs at the door and gate, install signs on the magenta beacon radiation alarms, complete fence sections on top of the tunnel gate, and plug in the Monitrons (ORNL radiation detectors). These tasks will be completed prior to certification Monday.

The phase 1 design as built drawing package was received from Sverdrup.

The Chipmunk vendor has completed testing of alternative components to replace the FET that is no longer available. No components have been found that meet the same performance requirements as the original part. Testing does indicate that one replacement device (a FET with the same part number but from a different manufacturer) does allow the Chipmunk to perform to a less stringent specification. We intend to have the vendor rebuild the original two prototype units with the replacement devices for testing. The SNS and Radiation Instruments Calibration Laboratory (RICL) procedures for Chipmunk calibrations have been approved. Calibration of the first eight units should start next week after completion of phase 0.3 certification.

The standalone Oxygen Deficiency Hazard (ODH) system for the recovery compressor is assembled in the lab and undergoing testing. The drawings and cabling database for the CHL are complete and will be issued next week. The cable required for the CHL is on site and the work orders for the CHL and LINAC have been processed. A material list for the remaining field equipment for the CHL has been developed and the equipment will be ordered next week.

#### Installation

Craft Snapshot 4/9/03

ASD craft workers	73.0
Foremen, ES&H, etc	10.0
Less WBS 1.9 controls	6.0
Less absent	3.0
TOTAL	74.0

DTL #1 was moved out of position into the Front End Building in preparation for drift tube installation. The o-ring between the two DTL #1 tanks was replaced.

DTL #3 RCCS testing was started.

The D-Plate was move into the DTL #2 position after the DTL #1/DTL #3 shielding wall was completed.

The first half-cell for the Ring was moved into the HEBT for temporary storage in prep for installation. This was the sixth half-cell received from BNL. The other five are stored in RATS I.

Installation of the trailers for the ASD Site Office continued. All ten trailers have been received.

The Ring Crane was successfully load tested. See Attachment.

# **Accelerator Physics**

#### **Operations Group**

ARR Preparation: Revising and writing OPM procedures, little response from those sent out for comment, needed for the ARR Commissioning Lessons Learned submitted to SNS Corrective Action Tracking System-requires formal sign-off by responsible individuals.

Working on DTL Tanks 1, 3 ARR Scheduling issues, preparing for DTL 3 processing.

Interviewed Operator candidates.

Worked on CLO planning for ASD office and lab space.

Working with CF on the Ring HVAC ducts and radiation shielding.

ASD Maintenance Plan: Continuing with the installation and configuration process. Hope to have some equipment data and personnel data in for the DOE review. Use ASD as a template for SNS, probably use Controls as the template for ASD. Had a meeting at ORNL with their outside contractors on CMMS systems for ORNL. They were very impressed with the SNS approach.

Chief Operator Training sessions are being held in preparation for Tank 3 Processing and Tank 1 Commissioning. All are expected to be certified RGD Custodians.

# **Ion Source Group**

The LEBT re-assembly was completed securing all screws with Belleville washers. After an accurate alignment, the reentrant flange with the LEBT were installed in the LEBT tank. This was accomplished using the LEBT installation cart that was designed, built, and implemented by Syd Murray. Using two x-y tables allows for smooth movements and positioning when the LEBT is installed or extracted, eliminating the risk of damaging the LEBT during installation.

Using the Laser tracker, the extractor aperture has been aligned within 0.2 mm.

# **Survey and Alignment Group**

# **Mechanical Group**

The final leak testing of DTL-3, before conditioning begins late next week, is in progress. Three of the four dipole DT's have air leaks from the interior of the DT (which is vented) to the tank interior. All four of these DT's are currently being differentially pumped.

The DTL-3 downstream and upstream shield walls have been completed. These walls are used to provide shielding for DTL-3 during conditioning.

The DTL-1 tank has been moved from the beam line to the FE building where DT installation will begin late next week. The o-ring on the center flange of the tank was replaced on Thursday in an attempt to repair a vacuum leak. The tank will be re-leak checked next week.



DTL-1 in FE Building

### Ring installation

• Installation of the HEBT SB cable tray continued.

- Installation of the HEBT SB transformers started.
- Installation of the HEBT SB AC distribution started.
- The 2 RING cranes were functionally and load tested and are ready for service.
- Received RING half-cell #6 magnet assembly and staged it in the HEBT tunnel.
- Transferred all the 12Q45 magnet support stands onto site and staged them in the HEBT tunnel.

#### Water Installation

- Filled DI water lines to the HVCM and SCR cabinets in the RFTF.
- Continued piping to equipment in the RFTF.
- Installed drift tube coolant hoses on DTL-3 in the tunnel.
- Filled and leak-checked lines to DTL-3 in the tunnel.
- Inspected CCL manifolds for CCL 2,3, and 4.

Continued work on installation of compressed air and water to Hot Test Stand Big Blue Box in the FEB.

ASD had a successful functional and load test of the RING Main Crane Thursday. Those individuals involved in operation of the crane attended an Operator and Maintenance Training Session followed by a brief hands-on practical training session in the tunnel.



Half-Cell #6 arrived at the SNS site first thing Thursday morning and was successfully off-loaded into the HEBT Tunnel. We also off-loaded the Half-Cell transport container at that same time, and we will begin shuttling the five half-cell assemblies from the RATS facility up to the HEBT within the next couple of weeks.







# **Magnet Task**

We have finished production measurements of HEBT 12Q45 Quadrupoles.

We are in the process of staging two HEBT Dipoles in order to check fit-up of beam vacuum chambers.

We are starting production measurements of HEBT 16CD20 correctors.

### **HPRF**

HPRF: Two RTD water temperature sensors were mounted on the DTL3 window for calorimetry and protection. Flow data will be obtained from the DTL3 RCCS and temperature data from the HPRF PLC.

Loss measurements were made on the directional coupler and its cable at the DTL3 klystron output. 100 Watts input at the waveguide resulted in -11 dBm measured at the HPRF control rack FWD power input. This will enable us to accurately interpret the klystron output power for DTL3 conditioning.

A presentation was made to the SNS Operations staff on HPRF fundamentals and safety.

The RF group is verifying the calibration of the readbacks for the DTL 3 system in particular the RF forward and reverse power readbacks.

Work in the RFTF on the 805 transmitter water circuits and the HVCM is proceeding, the HVCM is being assembled and should be ready when the 13.8 KV energized, sometime next week. 1st SC transmitter is up on site and is being readied for 6-550 Klystrons.

We continue to have difficulties with the QEI amplifier systems. Tow Owen is at BNL this week and noticed they also have QEI RF systems and these systems have identical problems. We will have the systems up for the commissioning date, but at what level is a guess. Better systems need to be identified now.

We wish to test the DTL 1 & 2 Klystron into a short soon hopefully next week. A 5th 402.5 tube in the rats building will be on site Wednesday next week so the final piping for DTL 5 & 6 RF systems can be completed. I'm told it will take 2-weeks for finish piping to both systems. We will be moving a HVCM shell into the ME3 position so piping and electrical work can be finished. Hoping to have all this finished by the review.

### LLRF

# **Electrical Group**

DTL 1 and DTL 2 corrector power supplies have been installed in the klystron gallery and tested using local controls into a short circuit. DTL 2 power supplies have been configured for the D-plate requirement (140A for the quadrupole, 20 A bipolar for each of two correctors). Testing with EPICS controls will commence next week. DTL 3 corrector power supplies are under test at RATS in preparation for installation in the klystron gallery next week.

Ken Rust and William Barnett visited BNL this week to observe testing on injection kicker power supplies. They also visited APS, who are producing the extraction kicker power supplies, to observe progress.

Dave Anderson and Eddie Tapp are visiting Dynapower to perform acceptance tests on the ME3 modulator for DTL 5 and DTL 6. Several Q/A issues arose, the most serious of which led to IGBT failures during testing. The cause of these failures was a failure to follow the proper written assembly procedures and checks. Because of this, the modulator in the RF Test facility was disassembled to check for assembly variances.

ME1 modulator has been tested successfully to 1 ms pulse length, 10 Hz, 115 kV, and has been turned over to the RF group for klystron RF systems commissioning. ME2 modulator continues to run in support of RF commissioning of DTL3 klystron RF systems.

Five additional electricians have been hired for the installation effort. 50% of the cable tray in the HEBT service building has been installed. Work in klystron gallery includes work on AC panel for the SCL, DTL terminations, and diagnostics and LLRF cable pulls.

# **Cryogenics Group**

CHL: Work continues on the instrument air and the LN2 piping installation. We have set up a constant GN2 purge on the charcoal bed. The purifier-piping package is out for fixed price bid, with bids due back this week. Status of the warm helium compressors is now displayed in the CHL control room. The two damaged first stage oil pumps from the warm helium compressors have been returned to the manufacturer. Repair of the pumps exceeds the cost of replacement so new pumps have been ordered.

Tunnel: The outer vacuum jacket clamshells for the west end return transfer line have been tacked in place and final welding will start today.

RATS: The assembly tables have been shipped to storage. Work has started on the assembly of the transfer line valve actuators.

# **Beam Diagnostics**

BNL Beam Diagnostics Progress Report:

General:

1.5.7.1 BPM: Finished fabrication of parts for the 6 additional 30cm BPMs. In response to Diagnostics Design Review Committee recommendation, partitioning of function in the PCI-based systems was carefully and

extensively evaluated. A decision was made to move ahead with two-board configuration for the BPM, with digitizers and some gain on the PCI/timing board, and calibration components and RF and Baseband AFE's on the second board. Prototype of the AFE board has been submitted for layout. The PCI/digitizer board will also be used for the IPM.

- 1.5.7.2 IPM: Work continues on magnet and vacuum chamber design
- 1.5.7.3 BLM: A successful test was conducted that exercised all the components in the BLM-related machine protect signal path from the BLM ion chamber thru the MPS application. Construction of a prototype AFE chassis with a hand-wired backplane that can process 8 BLM signals is underway. After doing system testing here at BNL this chassis will be delivered to ORNL. AFE chassis PCB backplane routing continues, as does assembly of the 8 channel AFE test stand. Parts kits have been delivered to a stuffing house for assembly of four more 8-channel AFE modules. MPS comparator/interface PCB is in checking, we expect prototype boards fabricated next week. A protection circuit for the calibration system electrometer has been built. We are waiting for a quote from LND for BLM ion chamber end cap costs. We have already received a quote from Norpin Manufacturing, which remains an attractive solution. Preparations to assemble a bare 9813KB PMT with base are underway as requested by SNS at ORNL. We are waiting for approvals for increased costs of 6.5% for the ISEG HV bias supply before placing an order. A moveable BLM stand with locking wheels has been received. It will hold a lead shielded BLM at adjustable heights with 100' of signal and bias cable on a reel near its base.
- 1.5.7.4 BCM: The BCM to be shipped to ORNL is undergoing final assembly to include the most recent configuration of the prototype calibrator. All of the prototype calibrators have been received. Finished welding the aluminum housings for the 5 HEBT BCMs. All the aluminum parts were sent out for irritating. Welding of the vacuum breaks with the beam pipes and work on the support design continues. Again in response to Diagnostics Design Review Committee, partitioning of function will remain as it is in the BCM system. Retrofit will be to swap BNL PCI/timing decoder cards for the LANL PCI interfaces as they become available.
- 1.5.7.6 Carbon Wire Scanner: Finished welding 10WS beam box assemblies. Continued welding another 2 beam box assemblies. Baked 4 WS beam box assemblies. Continued working on the support design.
- 1.5.7.7 BIG: Pulser vendor search continues. A quote from JP Accelerator Works Inc. for \$79,500 per modulator (total \$318K) has been received. Other quotes are: DTI-\$210K, Polarity-\$610K. Work on the formal spec continues. The question of RFP vs. RFQ has not been resolved. RFP has been suggested by BNL procurement to provide for a best technical proposal. Ability to accommodate 1-1/4" Heliax in cable trays has been verified by Dave Purcell. The need to substitute Rexolite for Teflon in the Andrew 1-5/8" EIA flange connector is under investigation at Andrew.

# LANL Beam Diagnostics Progress Report:

BPM pickups: DTL pickup #9 is now in final machining, having it's extension tubes welded on. DTL #10 has had its leaky feedthrough successfully replaced. Feedthroughs for DTL #11 have been sent to ESCO to weld into the BPM body. The last two SCL BPMs have been mapped, and they will be sent to ORNL soon. This will complete the SCL deliverables.

BPM electronics: Three members of the diagnostics team are at ORNL this week to install 3 ea. BPM chassis for the D-plate, conduct phase measurement tests, resolve shared memory DLL issues, and to work on the PCI timing card.

WS actuators: Huntington has given us an estimated ship date of 30/Jun for the prototype 3-inch and 6-inch actuators. No estimate yet on ship dates for the 8 and 12-inch prototype actuators.

WS electronics: The two chassis with Phytron linear driver modules are ready to ship. They will be evaluated at ORNL, and then we will down select between this type of driver module and the National Instruments stepper motor driver modules. We are putting together the kits for the signal processor PC board stuffing. The contract for the stuffing and the order for the PC's are with the buyer.

ED/FC: Bid packages were released this week for the remaining 5 ea. ED/FC actuators. Work continues to fab two

more ED/FC chassis.

D-plate: We received five more actuator reinforcing clamps for the stepper motor actuators mounted on the D-plate. We will pass these on to ORNL. The adapter spool piece for the BCM vacuum feedthrough is now delayed until the end of April due to vendor delays. The D-plate RCCS and vacuum system checks are now scheduled for the week of May 12. The software for these systems will be cut this week, and shipped to ORNL next week along with the hardware needed for the camera control and image processing.

Harp: We are converging on the concept of using 1-pF ceramic capacitors mounted directly to the signal plane PC boards and connected to each signal wire, to add self-test capability.

### ORNL Beam Diagnostics Progress Report:

D-plate: We moved the D-plate to the tunnel. Alignment group is scheduled to survey the quad and verify the actuator positions with respect to the center of the beam-line. We had three visitors from LANL to help us in testing the BPM electronics. The new BPM electronics were connected to a low phase noise oscillator and simulated beam signals were measured. John Power is analyzing the data and will compare it to results from the MEBT electronics. The majority of Matt Stettler's time was spent on the timing and LLRF electronics.

Anti-chopper D-box: After the successful tests on the prototype actuator, we are building 4 more actuators to complete the device.

Timing: Tom, Matt, Lisa and Craig Swanson met to refine the minimum requirements for the timing card support software. We expect that the existing hardware design will support these requirements and that the driver and DLL could be ready in time for DTL commissioning.